

I. Choose the correct answer:

- The SI unit of magnetic induction is
 a) $NA^{-1}m^{-1}$ b) tesla c) $Jkg^{-1}K^{-1}$ d) both (a) and (b)
- 1 parallaxic second is equal to
 a) $3.08 \times 10^{16}m$ b) $9.467 \times 10^{15}m$ c) $1.496 \times 10^{11}m$ d) 326 light year
- If the velocity is $\vec{v} = 2\hat{i} + t^2\hat{j} - 9\hat{k}$, then the magnitude of acceleration at $t = 0.5$ second is
 a) $1ms^{-2}$ b) $2ms^{-2}$ c) $-1ms^{-2}$ d) $9.8ms^{-2}$
- Force acting on the particle moving with constant speed is
 a) always zero b) need not be zero
 c) always non zero d) cannot be concluded
- The electric energy consumed in electrical units when a 75 W fan is used for 8 hours daily for one month (30 days) is
 a) 18 unit b) 1.8 unit c) 180 unit d) 1 unit
- If the linear momentum of the object is increased by 0.1%, then the kinetic energy is increased by
 a) 0.1% b) 0.2% c) 0.4% d) 0.01%
- The center of mass of a system of particles does not depend upon
 a) position of particles b) relative distance between particles
 c) masses of particles d) force acting on particle.
- If the mass and radius of the Earth are both doubled then the acceleration due to gravity g'
 a) remains same b) $\frac{g}{2}$ c) 2g d) 4g
- Water rises in a capillary tube to a height of 2 cm. How much will the water rise through another capillary tube whose radius is one-third of the first tube?
 a) 2 cm b) 1 cm c) 6 cm d) 3 cm
- If a wire is stretched to double of its original length, then the strain in the wire is
 a) 1 b) 2 c) 3 d) 4

- When a cycle tyre suddenly bursts, the air inside the tyre expands. This process is
 a) isothermal b) adiabatic c) isobaric d) isochoric
- If the temperature and pressure of a gas is doubled, the mean free path of the gas molecules
 a) remains same b) doubled c) tripled d) quadrupled
- The phase difference between displacement and acceleration of a simple harmonic motion is
 a) -90° b) 180° c) zero d) 45°
- The damping force on an oscillator is directly proportional to the velocity. The units of the constant of proportionality are
 a) $kgms^{-1}$ b) $kgms^{-2}$ c) $kg s^{-1}$ d) $kg s$
- Which of the following represents a wave?
 a) $(x - vt)^3$ b) $x(x + vt)$ c) $\frac{1}{(x + vt)}$ d) $\sin(x + vt)$

PART-II

Note: Answer any six questions in which Q.No. 21 is compulsory. 6x2=12

- Define velocity and speed.
- A particle of mass 2 kg experiences two forces $\vec{F}_1 = 5\hat{i} + 8\hat{j} + 7\hat{k}$ and $\vec{F}_2 = 3\hat{i} - 4\hat{j} + 3\hat{k}$. What is the acceleration of the particle?
- Define the loss of kinetic energy in inelastic collision.
- What is radius of gyration?
- If the ratio of the orbital distance of two planets $\frac{d_1}{d_2} = 2$, what is the ratio of gravitational field experienced by these two planets?
- Why the passengers are advised to remove the ink from their pens while going up in an aeroplane?
- State Stefan-Boltzmann law.
- What is the microscopic origin of temperature?
- What is meant by free oscillation?

PART-III

Note: Answer any six questions in which Q.No. 33 is compulsory. 6x3=18

- Write a note on triangulation method and radar method to measure larger distances.
- Write down the kinematic equations for angular motion.

27. A car takes a turn with velocity 50 ms^{-1} on the circular road of radius of curvature 10 m. Calculate the centrifugal force experienced by a person of mass 60 kg inside the car?
28. State and explain work energy principle.
29. How do you distinguish between stable and unstable equilibrium?
30. State and prove Pascal's law in fluids.
31. Why does heat flow from a hot object to a cold object?
32. What is meant by maintained oscillation? Give an example.
33. Consider a mixture of 2 mol of helium and 4 mol of oxygen. Compute the speed of sound in this gas mixture at 300 K.

PART-IV

Note: Answer all the questions.

5x5=25

34. a) Derive the equation of motion, range and maximum height reached by the particle thrown at an oblique angle θ with respect to the horizontal direction.

(OR)

- b) Explain the motion of blocks connected by a string in vertical motion.

35. a) Arrive at an expression for elastic collision in one dimension and discuss various cases.

(OR)

- b) i) State principle of moments.

- ii) State and prove parallel axis theorem.

36. a) Derive the time period of satellite orbiting the Earth.

(OR)

(OR)

- b) State and prove Bernoulli's theorem for a flow of incompressible, non-viscous, and streamlined flow of fluid.

37. a) Derive Mayer's relation for an ideal gas.

(OR)

- b) Derive the ratio of two specific heat capacities of monoatomic, diatomic and triatomic molecules.

38. a) Write short notes on the oscillations of liquid column in U-tube.

(OR)

- b) Discuss the law of transverse vibrations in stretched strings.